Appendix F.
Prioritized Control Plans for Non-native Invasive Plant Species at the Cedar Roughs Wildlife Area

Note: the proposed measures are as recommended primarily by Bossard et al. (2000) and by Element Stewardship Abstracts produced by the Nature Conservancy and available at http://tncweed.ucdavis.edu/esadocs/.

Scientific name: Aegilops triuncialis
***Common name*: Barbed Goatgrass**
Updated 9/2003

PRIORITY 1

- **Description**

Barbed goatgrass is an annual grass native to Eurasia that reproduces in late spring (seedheads ripen by late-May to mid-June). Barbed seedheads allow seeds to be easily transported from site to site by wild and domestic animals, and they are also transported by moving water. Goatgrass can spread rapidly, progressing from initial invasion to dominance of an entire ranch within 20 years.

- **Current Distribution on the Site and Treatments to Date**

Barbed goatgrass is at the very earliest stages of invasion at the CRWA. In November 2003, University and Department personnel discovered a single patch along a trail in the Lake Berryessa Unit. This patch was approximately 1 meter wide and 20 meters long. No other occurences of goatgrass were discovered along any of the trails or in any of the grasslands at the CRWA. This patch was sprayed with Roundup in April 2004.

- **Damange and Threats**

Goatgrass is particularly threatening to the biological goals for the CRWA because it can invade serpentine grasslands and seeps, which harbor many of the special status plants at the Wildlife Area and which are refugia for many native grasses and forbes that are displaced in non-serpentine grasslands by invasive European annual grasses. Goatgrass can form dense stands that crowd out most native species.

- **Measurable Goals and Objectives**

Eradicate barbed goatgrass from the CRWA and immediate vicinity. Monitor regularly to catch any recurrent establishment.

- **Management Options**

Management options for goatgrass include prevention of new infestations and eradication of the existing infestation.

Prevention—Prevention will include reducing the likelihood of seed introductions into uninfested areas and avoiding conditions that may increase its seed establishment (e.g., areas of disturbed soil). Examples of strategies to prevent seed introductions include (1) aggressive monitoring to enable early detection and rapid eradication of nascent foci, and (2) educating the public and Department staff members on how to

identify goatgrass and remove seedheads from their clothing, pets, and vehicle undercarriages when leaving goatgrass-infested areas.

Eradication and control

- *Controlled burning:* Burning is believed to be the cheapest and most practical form of goatgrass control on large areas of infested land (DiTomaso et al. 2001). Research conducted at Hopland Field Station found that two successive years of controlled burning can virtually eliminate stands of goatgrass (DiTomaso et al. 2001). Timing is critical, with optimal results achieved by burning late in the spring before seed heads mature (DiTomaso et al. 2001; Peters et al. 1996). Burning during this time may favor the proliferation of native grasses, and thus have beneficial effects on a larger component of the plant community. Where burning is not feasible, alternatives, such as weed toasters, which apply intense localized heating, should be experimented with to determine their effectiveness as substitutes for fire.

- *Mowing:* Mowing alone has been reported to be an ineffective control agent because short or bent over seed stalks can be missed (Talbot and Smith 1930). Mowing may also encourage goatgrass because mowed plants can produce seed within a month after cutting. Marin Agricultural Land Trust reported on their website that mowing at end of growing season, but before seed set may be effective. Mowing may also be effective when combined with other treatments (Peters et al. 1996).

- *Grazing:* Heavy grazing by domestic livestock may control the spread of goatgrass by preventing its seeds from ripening (Peters et al. 1996). However, the timing of grazing is critical: it must be conducted in early spring before plants form awns. If grazed too late, livestock will selectively graze more palatable plants and leave goatgrass, and will also spread seeds (Kennedy 1928). Grazing may be a risky management treatment because cattle tend to avoid goatgrass (Jacobsen 1929). Because heavy grazing is be required to reduce infestations and appropriate timing is during the later part of the peak phenology period (Peters et al. 1996), there exists the danger that the levels of grazing required to reduce goatgrass may also reduce the cover of more palatable and otherwise desirable native plants and create areas of disturbed soil that are vulnerable invasions.

- *Chemical control:* Application of 0.38-0.75 lb/acre of glyphosate (Roundup) has been shown to be effective in spot control of small patches (Peters et al. 1996), but as it is non-selective, it is not suitable for large areas. Treatments should be conducted in the spring after plants have tillered, but before flowering. However, the authors of this study stated that treated areas should be reseeded with appropriate perennial grass/clover mixture.

- *Native restoration:* Reseeding and restoration of native species should be conducted following herbicide treatments to replace plant cover (DiTomaso et al. 2001).

❖ **Actions Planned (Treatment and Monitoring)**

Spring 2005: Revisit existing infestation. Spray new plants with Roundup. Survey surrounding area for nascent foci that may have escaped detection. Survey all trails and serpentine grasslands for new infestations.
Spring 2006: Revisit existing infestation. Spray new plants with Roundup. Continue to survey all trails and grasslands annually.

Scientific name: Tamarix parviflora
***Common name*: tamarisk, salt cedar**
Updated 9/2003

PRIORITY 2

❖ Description

Tamarisk is a many-branched shrub or tree less than 26 feet tall with small, with scale-like leaves that contain salt glands, and small white to deep-pink flowers.

❖ Current Distribution on the Site and Treatments to Date

Most tamarisk on the CRWA is concentrated in the riparian corridor of Pope Creek. At least one, but not more than a few individual plants occur along Maxwell Creek. Ultimately the Department would like to see tamarisk eradicated from Pope Creek, both within and outside the CRWA. Efficient tamarisk eradication along Pope Creek will require coordination with landowners and land managers both upstream and downstream of the CRWA Pope Creek. Because the Department manages only short segments of Pope Creek and because of the cost and complexity of organizing a large-scale cooperative eradication effort, the interim goal of the Department will be to eradicate tamarisk from Maxwell Creek and prevent its reintroduction. No tamarisk control has occurred within the CRWA to date.

❖ Damage and Threats

Tamarisk has the ability to crowd out native riparian species, reducing both plant and animal diversity, and increasing soil salinity to favor itself. It also alters hydrology, drying up springs and riparian areas and streams and lowering surface water tables.

❖ Measurable Goals and Objectives

Eradicate tamarisk from Maxwell Creek, monitor treated infestations for resprouting, work with the BRBNA conservation partnership to explore a cooperative eradication effort in the Pope Creek watershed.

❖ Management Options

Prevention—Annual surveys to enable early detection and control, as well as prevention of seed introductions and disturbances that contribute to its success (fire, increased soil salinity, soil disturbance, etc) are critical to limiting tamarisk's distribution.

Eradication and control

- *Physical control:* Manual/mechanical methods do little to control tamarisk, since it resprouts vigorously following cutting or burning. Root plowing and cutting can

clear heavy infestations, but only when followed up with herbicide treatments. Seedlings and small plants can be hand pulled. Fire does not kill tamarisk roots, but helps to thin heavy infestations, while flooding for 1-2 years can kill most salt cedar plants in a thicket (Lovich 2000).

- *Biological control:* Insects and fungi are currently being tested for tamarisk control. Cattle have been shown to consume considerable amounts of sprout growth (Lovich 2000).

- *Chemical control:* Heavy infestations often require stand thinning through controlled burns and/or mechanical removal prior to herbicide application. Herbicides commonly used to combat tamarisk include imazapyr (e.g., Stalker, Arsenal), triclopyr (e.g., Garlon), and glyphosate (e.g., Roundup, Rodeo) (Lovich 2000). Triclopyr is typically applied to stumps after cutting. Perhaps the most effective technique is to apply imazapyr as “Arsenal” to the foliage, especially when a tank mix is used with a glyphosate herbicide such as Rodeo or RoundupPro (Lovich 2000). Arsenal is not registered for use in California, but "Stalker" is another imazapyr-based herbicide that is.

- *Integrated control:* The most frequently used method in California is to cut the shrub off to within 5 cm of the ground and apply triclopyr, either as Garlon 4 or Garlon 3A to the stump and around the perimeter of the cut stems within 1 minute of cutting, the latter of which should be applied during the growing season (Lovich 2000). Foliar application of herbicides to resprouts should be conducted within 4-12 months, and are best conducted with glyphosate or imazapyr; best results are achieved via application in late spring to early fall during good growing conditions (Lovich 2000).

❖ **Actions Planned (Treatments and monitoring)**

Spring 2005: Spray plants along Maxwell Creek with "Stalker."
Summer 2005: Survey for resprouting, continued treatments as needed.

Scientific name: Dipsacus sativus
***Common name*: Teasel**
Updated 9/2003

PRIORITY 3

❖ Description

Teasel is a non-native biennial forb that stands 3-6 feet tall, produces a basal rosette for at least one year during which time it extends a deep tap root, and flowers between June and September. Teasel's unique inflorescence makes the plant readily identifiable when blooming. It tends to prefer mesic habitats, but can invade drier sites.

❖ Current Distribution on the Site and Treatment to Date

Teasel occurs in only a single isolated location in the Maxwell Creek Unit near where the northern boundary of the Unit intersects the south bank of Pope Creek.

❖ Damage and Threats

Teasel can invade serpentine seeps and displace special status plants species and other native species that occur in this habitat. It also tolerates drier sites, and thus poses the threat of invading neighboring grasslands.

❖ Measurable Goals and Objectives

Eradicate teasel from the CRWA by summer 2005.

❖ Control Options

- *Physical control*—For the small patch of teasel on the CRWA, mechanically removing existing plants before seed set during early summer (e.g., with a machete) year after year until there no longer resprouts, and then pulling any seedlings or young rosettes during early-mid spring should prove effective. Once flowering has begun, the flowering heads should be cut off and removed from the site, because immature seed heads left in place can still develop some viable seeds. Cutting off the flowering stalks just at flowering time will usually prevent resprouting from the root crown.

- *Integrated control*—Following mechanical removal, wick application of herbicide to the remaining rosette is recommended, though this could pose a threat to seep habitats.

- *Monitoring*—The site should be monitored annually to detect resprouts, and additional treatments applied accordingly.

❖ **Actions Planned (Treatments and monitoring)**

Late spring – early summer, 2005: Mechanically remove teasel infestation.
Late spring – early summer, 2006: Survey and continue removal as necessary

Scientific name: Ailanthus altissima
***Common name*:** tree-of-heaven
Updated 9/2003

PRIORITY 4

❖ Description

Tree of heaven is native to Asia. It is a deciduous tree, thirty to sixty feet high, with large pinnately compound leaves. It has been planted extensively as an ornamental in Europe and the United States until the late 1800s.

❖ Current Distribution on the Site and Treatments to Date

Tree-of-heaven is concentrated in areas around past settlements and intensive human activity and in riparian areas. At the CRWA it occurs in both Units. At the Lake Berryessa Unit it occurs in a small clearing near an old cabin or barn above the south bank of Pope Creek. In the Maxwell Creek Unit it occurs in a single stand along Maxwell Creek. In May 2004, Department personnel treated the infestation at the Lake Berryessa Unit (one large old tree and about 30 sucker sprouts of varying heights) with 30% Garlon in an oil mixture using a basal bark treatment for sprouts and by cutting into the bark and applying herbicide to the cambium of the large tree. In August 2004, only about 50% of the sprouts were dead and the large tree showed only minor signs of die-off indicating that the treatment will need to be re-treated.

Damage and Threats

Tree-of-heaven can spread by seed as well as by root sprouts, but its primary threat is its ability to form dense thickets from root sprouts. These thickets can displace native species in riparian areas.

❖ Measurable Goals and Objectives

Eradicate tree-of-heaven from the CRWA by summer 2007.

❖ Management Options

- *Physical control*—Tree-of-heaven can be killed by cutting or girdling, but death of the main stem usually promotes prolific root sprouting, even when stumps are treated with herbicide.

- *Chemical control*—Small sprouts may be killed by a foliar application of glyphosate (Roundup), and larger sprouts with an application of 15-20% triclopyr (Garlon) to all of the bark in the first 20 inches of the stem. On larger trees, the bark must be removed and the cambium exposed before applying herbicide. There is some evidence that this technique is most efficient if the entire trunk is not girdled prior to applying herbicide. Leaving 1 to 2 inches of bark intact

between cuts prevents the tree's emergency response and results in ultimate death of the main stem without root sprouts.

- **Actions Planned (Treatments and monitoring)**

Summer 2005: Apply a hack and squirt technique with Garlon to large trees in both units. Apply Garlon directly to sprouts.
Summer 2006: Monitor results of previous treatment, re-treat or modify treatment as necessary. Monitor annual until there is no evidence of resprouts.

Scientific name: Centaurea solstitialis
***Common name*: Yellow starthistle**
Updated 9/2003

PRIORITY 5

❖ Description

Yellow starthistle is an annual to biennial forb that germinates in the fall and produces a rosette during early spring, during which time it extends a deep taproot downward. It bolts in the late spring after annual grasses senesce and flowers during late June-August.

❖ Current Distribution on the Site and Treatments to Date

Starthistle has limited distribution within the CRWA, because it typically does not invade serpentine soils. The primary infestation is the floodplain along Maxwell Creek at the south end of the Maxwell Creek Unit.

❖ Damage and Threats

Starthistle reduces native biodiversity by forming monospecific stands, and can hinder the establishment, reproduction, and persistence of native species (DiTomaso and Gerlach 2000). It also degrades wildlife habitats and hinders public access.

❖ Measurable Goals and Objectives

Reduce starthistle cover along Maxwell Creek and prevent spread into uninfested areas.

❖ Management Options

- *Physical control:* repeated mowing/weed wacking during the early flowering or bolting stage; or hand pulling of smaller infestations during the same stages, may work, but may also negatively impact late-season forbs.

- *Controlled burning:* prescribed fire during the early flowering or bolting stage has been shown to reduce seed production, and three years of it may almost entirely remove infestations and seed banks (DiTomaso et al. 1999). It may also reduce the cover of barb goatgrass and medusahead (DiTomaso 2000). Such burns are likely to also reduce the cover of additional exotics, including goatgrass and medusahead, and may therefore be applied as part of a whole-systems approach to restoring communities from starthistle invasion.

- *Carefully timed controlled grazing:* during the bolting stage, grazing by goats, especially has been shown to reduce seed production (Thomsen et al. 1993;

DiTomaso 2000), though the intensity of grazing required may be detrimental to native species and soils, and inputs of urine and dung may increase soil fertility and invasibility (Thomsen et al. 1993; Tu et al. 2001).

- *Chemical control:* early season application of Clopyralid (Transline) has been shown to dramatically reduce starthistle cover when applied at low levels (1.5-4 oz/acre) from January to May, but has detrimental effects on some native species within the Apiaceae, Asteraceae, Fabaceae, Polygonaceae, Solanaceae, and Violaceae families and has residual effects on soils for 1 year.

- *Biological control:* Six biological control species have been introduced to reduce yellow starthistle abundance, but are only roughly 40% effective (DiTomaso 2002). Some reports indicate that these insects are beginning to have an increasingly pronounced effect on this weed.

- *Restoration:* Native species such as perennial bunchgrasses and tarweeds have been shown to increase the resistance of habitats to starthistle invasion (Dukes 2002; Gelbard 2003). Fortunately, controlled burns timed to reduce starthistle reproduction and cover have been shown to favor native bunchgrass species such as *Nassella pulchra* (DiTomaso et al. 1999).

Overall, several years of integrated treatments may be necessary to reduce cover of yellow starthistle and to restore invaded habitats.

Scientific name: Taeniatherum caput-medusae
***Common name*: Medusahead**
Updated 1/2005

PRIORITY 6

❖ Description

Medusahead is an annual grass that forms dense stands in California grasslands, including serpentine grasslands. Medusahead matures one to four weeks later than most other annual grasses: flowering occurs in May and seeds usually disperse by mid-summer (Kan and Pollak 2000).

❖ Current Distribution on the Site and Treatments to Date

Medusahead occurs in most grasslands within the CRWA, although generally at low density because of the serpentine influence.

❖ Damage and Threats

Medusahead reduces native biodiversity by forming dense monospecific stands. Unlike most annual grasses, the silica-rich plants do not break down over the winter and usually form a dense thatch that hinders the establishment, reproduction, and persistence of native species (Kan and Pollak 2000).

❖ Measurable Goals and Objectives

Reduction in the cover of medusahead will be difficult, because it is widespread the the CRWA and because it occurs in grasslands mixed with many native species, including some special-status serpentine endemics. It will be a challenge to reduce the cover of medusahead without also negatively impacting native species. Medusahead control at the CRWA, if feasible, will target only high-density patches.

❖ Management Options

- *Physical control:* Mowing can be effective, but because of the difficult access, mowing at the CRWA would have to be done with hand tools (e.g., gas powered line trimmers).

- *Controlled burning:* Prescribed buring is probably the most effect means for controlling medusahead (Kan and Pollak 2000). Prescribed burns can take advantage of the fact that medusahead flowers later than other species, so that many native species will have already dropped their seed when burning occurs. Burning should occur in late spring prior to seed drop. The lack of vehicle access if the primary impediment to conducting prescribed burns at the CRWA. In addition, because of the high density of special-status plants in and around

medusahead populations, firelines should be made using methods (e.g., blacklining, weed-trimmers) that minimize surface disturbance.

- *Carefully timed controlled grazing:* Grazing in early spring, when medusahead is still palatable, can reduce but not eliminate medusahead infestations.

- *Chemical control:* Small, but dense patches of medusahead could be treated with herbicides.

Realistic options for medusahead control at CRWA are limited, primarily due to difficult access.

Appendix F References

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